



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/722,558	11/28/2003	Stefanie R. Chiras	YOR920030367US1 (20140/03)	4980
30678	7590	05/05/2006	EXAMINER	
CONNOLLY BOVE LODGE & HUTZ LLP SUITE 800 1990 M STREET NW WASHINGTON, DC 20036-3425			BOOTH, RICHARD A	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 05/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/722,558	<b>Applicant(s)</b> CHIRAS ET AL.	
	<b>Examiner</b> Richard A. Booth	<b>Art Unit</b> 2812	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 February 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,3-15 and 17-32 is/are pending in the application.
- 4a) Of the above claim(s) 23-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3-15,17-22,31 and 32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 and 3-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al., EP 1 233 448 in view of Lee et al., U.S. Patent 6,486,059.

Lu et al. shows the invention as claimed including a process for forming an electrically conductive metallic interconnect in a via in a dielectric which comprises: providing a dielectric layer (102,104) in a substrate wherein the substrate comprises electrically conductive copper lines 101, forming a trench or via 106,108 in the dielectric layer and exposing electrically conductive line in the substrate; depositing a first liner layer 124 comprising, for example, tantalum on the walls and bottom of the trench or via; removing residual contamination from the bottom of the trench or via using argon etching (see fig. 3C); depositing a second liner layer 126 of tantalum on the walls and the bottom of the trench or via; depositing a copper seed layer (see paragraph 0021) in the trench or via and filling the trench or via with electrically conductive material 118 such as copper (see figs. 3A-3F and paragraphs 0010-0022).

Lu et al. is applied as above but does not expressly disclose a low-K dielectric material having a dielectric constant of less than 3.9.

Lee et al. discloses forming an interlayer dielectric of a material such as SiLK which has a dielectric constant in the claimed range (see col. 2-lines 20-36). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Lu et al. so as to form an interlayer dielectric of the claimed material because such an interlayer dielectric is a suitable material to be used in metallization processes.

Claims 15 and 17-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al., EP 1 233 448 in view of in view of Lee et al., U.S. Patent 6,486,059 as applied to claims 1 and 3-14 above, and further in view of Cole, Jr. et al., U.S. Patent 5,897,368.

Lu et al. and Lee et al. are applied as above but do not expressly disclose depositing an adhesion layer prior to depositing the first liner layer, and wherein residual contamination and the adhesion layer are removed from the bottom of the trench prior to depositing the first liner layer.

Cole, Jr. et al. discloses forming an adhesion layer 22 in a via and removing the adhesion layer from the bottom of the trench prior to depositing additional metallization layers (see figs. 2-4 and col. 3-line 49 to col. 4-line 31). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Lu et al. so as to form an adhesion layer on the inner vertical surfaces of the via because this will allow for good adhesion of subsequently deposited layers. With respect to residual contamination being removed from the

bottom of the trench prior to depositing the first liner layer, the selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results (see *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946)).

Claims 31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al., EP 1 233 448 in view of Lee et al., U.S. Patent 6,486,059 as applied to claims 1 and 3-14 above, and further in view of Uzoh et al., U.S. Patent 6,140,234 or Schmidbauer et al., U.S. Patent 6,221,757.

Lu et al. and Lee et al. are applied as above but do not expressly disclose the tantalum being alpha tantalum. Uzoh et al. discloses the use of alpha tantalum as a metallization layer (see col. 3-lines 46-55), and Schmidbauer et al. also discloses the use of alpha tantalum as a metallization layer (see col. 4-lines 40-50). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Lu et al. modified by Lee et al. so as to have the tantalum be alpha tantalum because alpha tantalum has been identified as an important prerequisite for subsequent copper deposition.

### ***Response to Arguments***

Applicant's arguments filed 2/21/06 have been fully considered but they are not persuasive. Applicant argues that there is no motivation to combine the Lu et al. and Lee et al. references. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be

established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the motivation to combine the references is clearly stated in the above rejection.

Applicant's arguments with respect to claims 15-22 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Art Unit: 2812

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard A. Booth whose telephone number is (571) 272-1668. The examiner can normally be reached on Monday-Thursday from 7:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Richard A. Booth  
Primary Examiner  
Art Unit 2812

April 30, 2006